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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Boskamp, Eddy B.
Serial No.	:	10/063,550
Filed	:	May 2, 2002
For	:	Wireless RF Module For An MR Imaging System
Group Art No.	:	3737
Examiner	:	Jung, W.

CERTIFICATION UNDER 37 CFR 1.8(a) and 1.10

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Assistant Commissioner for Patents
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APPEAL BRIEF PURSUANT TO 37 C.F.R. §§1.191 AND 1.192

Dear Sir:

This Appeal Brief is being filed in furtherance of the Notice of Appeal filed on June 23, 2005.

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1. **REAL PARTY IN INTEREST**

The real party in interest is General Electric Co., the Assignee of the above-referenced application by virtue of the Assignment to General Electric Co., recorded on April 20, 2004, at real 016212, frame 0534.

2. **RELATED APPEALS AND INTERFERENCES**

Appellant is unaware of any other appeals or interferences related to this Appeal.

3. **STATUS OF THE CLAIMS**

Claims 1-4, 6-8, 10-18, and 20-30 are currently pending. Claims 1-4, 6-8, 10-18, and 20-30 are currently under final rejection and, thus, are the subject of this Appeal.

4. **STATUS OF AMENDMENTS**

Appellant submitted amendments subsequent to the Final Office Action on August 17, 2005 to address 35 U.S.C. §§101 and 112 rejections, and are believed to be entered to place the application in better condition for appeal. The after-final amendments were previously presented on April 25, 2005, but were not entered by the Examiner because of informalities. Accordingly, Appellant, after receiving leave from the Examiner to do so, submitted the August 17th after-final amendment addressing the informalities so that the previously presented after-final amendments overcoming the §§101 and 112 rejections could be entered. As such, it is believed that the previously made final 35 U.S.C. §§101, 112 rejections are moot and not part of this Appeal.

5. SUMMARY OF CLAIMED SUBJECT MATTER

A wireless RF module (70) for an MRI apparatus (10) having an oscillator (78) to generate a carrier signal and a modulator (76) wired to the oscillator (78) and configured to modulate a carrier signal with an MR signal in an RF coil (72) of the MRI apparatus (10) is claimed. *Boskamp*, US Pub. No. 20030206019, ¶8. A transmitter (80) is provided and configured to transmit the modulated MR signal. *Id.* A receiver (63) is wirelessly connected to the transmitter (80) and configured to receive the modulated MR signal for subsequent data processing and image reconstruction. *Id.*

A kit configured to retrofit an existing MRI apparatus (10) to wirelessly transmit an MR signal from a receive coil (72) to a receiver (63) is also claimed. *Id.*, ¶27. The receiver (63) is designed to input the received MR signal to a data processor (32) for subsequent image reconstruction. *Id.*, ¶25 The kit consists of a modulator (76) that modulates a carrier signal with an MR signal in an RF coil (72) of the MRI apparatus (10) and a transmitter (80) designed to transmit the modulated signal. *Id.*, ¶23 The kit further consists of a receiver (63) wirelessly connected to the transmitter (80) and configured to receive the modulated signal for subsequent data processing and image reconstruction. *Id.*, ¶25.

An MRI apparatus (10) having an MRI system including a number of gradient coils (50) positioned about a bore of a magnet (52) to impress a polarizing magnetic field is also claimed. Id., ¶9. The MRI apparatus (10) further includes an RF transceiver system (58) and an RF coil assembly (70, 72) configured to wirelessly transmit an MR signal to the RF transceiver system (58). *Id.* The RF coil assembly (70, 72) has an RF modulator (76) configured to modulate a UHF carrier frequency with the MR signal. *Id.*

The application also claims an MRI system (10) comprising means for positioning (48) a subject to be scanned within a bore of magnet assembly (52) for MR data acquisition. *Id.*, ¶10. The MRI system (10) further includes means for impressing (52) a polarizing magnetic field about the bore of the magnet (52) and means for exciting (56, 60, 62) nuclei in the subject. *Id.* The MRI system (10) further comprises means for sensing signals (56) resulting from the excited nuclei in the subject and means for wirelessly transmitting (70-86) the signals to a receiver means (58, 63, 64). *Id.* Means for reconstructing (22, 32) at least one image of the subject from the signals received by the receiver means (58, 63, 64) is also provided. *Id.*

Alternately, the MRI system (10) further has means for rectifying induced voltage generated during excitation of nuclei in the subject. *Id.*, ¶22.

Alternately, the MRI system (10) further includes at least one battery (65) and means for acquiring power from at a B field associated with an RF pulse sequence to recharge the at least one battery (65). *Id.*

An MRI apparatus (10) including an MRI system having a number of gradient coils (50) positioned about a bore of a magnet (52) to impress a polarizing magnetic field is also being claimed. *Id.*, ¶9. The MRI apparatus (10) further has an RF transceiver system (58) wired to a

modulator (76) and an RF coil assembly (70, 72) that wirelessly transmits an MR signal to the RF transceiver system (58). *Id.* The RF coil assembly (70, 72) includes the modulator (76) that is designed to modulate a carrier signal and a transmitter (80) to wirelessly transmit the carrier signal out of the bore of the magnet (52). *Id.*, ¶23. The MRI apparatus (10) further has a receiver (63) having an electric dipole antenna wirelessly connected to the transmitter (80) to receive the carrier signal transmitted by the transmitter (80). *Id.*, ¶24.

6. GROUNDS OF REJECTION

In the February 23, 2005 Office Action, the Examiner rejected claims 1, 2, 4, 6, 7, 17, 18, 20-23, and 25-28 under 35 U.S.C. §102(b) as being anticipated by Leussler (USP 5,245,288). *Office Action*, February 23, 2005, p. 4 Claims 3, 8, 10-16, and 24 stand finally rejected under 35 U.S.C. §103(a) as being unpatentable over Leussler in view of Schotz (USP 5,581,617). *Office Action*, February 23, 2005, pp. 4-5. Claim 20 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Leussler in view of Goto (USP 6,218,834). *Id.* Appellant contests the Examiner's grounds of rejection. The claims do not stand or fall together.

7. ARGUMENT

A. REJECTION UNDER 35 U.S.C. §102(b) BY LEUSSLER

Claims 1, 2, 4, 6, 7, 17, 18, 20-23, and 25-28 stand finally rejected as being anticipated by Leussler. The reference is directed to "a magnetic resonance examination apparatus [that] includes a coil system (10) for receiving spin resonance signals generated in an examination zone, and a processing unit remote from the examination zone for processing the signals received in the coil system." *Leussler*, USP 5,245,288, Abstract. In this regard, the reference discloses "a transmitter for transmitting the spin resonance signals" and the "transmitter cooperates in a wireless fashion with a receiver to which the processing unit is connected." *Id.* To this end, Leussler teaches that "the spin resonance signal induced in the coil 10 is amplified by a low-noise amplifier 111 and applied, via a frequency converter 112, 113 and a further amplifier 114, to an antenna 115 which transmits the signal as part of a high frequency signal." *Leussler*, col. 3, ll. 44-48. The reference further teaches that "the frequency converter comprises a mixing stage 112 in which the spin resonance signal is mixed with a mixing signal of constant frequency f_1."

Leussler, col. 3, ll. 55-57. In this regard, "the frequency f_1 of the mixing signal is chosen (from a few MHz to a few 100 MHz) so that the sum frequency $f_1 + f_0$ is sufficiently high to enable wireless transmission via sample antenna means." *Leussler*, col. 3, l. 67– col. 4, l. 2.

Further, "the frequency of the mixing signal is derived from a wireless transmitted auxiliary signal ..." *Leussler*, col. 4, ll. 15-19. As such, "there is provided an additional antenna 121 (if the antenna 115 were of sufficiently broadband type, it could also be used)." *Leussler*, col. 4, ll. 19-21. Specifically, Leussler teaches that "the output signal of the oscillator 224 is applied on one hand as a mixing signal to an input of the mixing stage 211 and on the other hand to an amplifier 225 which is connected to an antenna 226 which cooperates with the antenna 121 in the transmitter." *Leussler*, col. 5, ll. 53-57.

CLAIM 1

Claim 1 is directed to "a wireless RF module for an MRI apparatus." The RF module, as set forth in claim 1, has an oscillator and a modulator wired to the oscillator to modulate the carrier signal provided by the oscillator with an MR signal in an RF coil of the MRI apparatus. Claim 1 further calls for a transmitter is provided and designed to transmit the modulated signal to a receiver wirelessly connected to the transmitter and designed to receive the modulated signal for subsequent data processing and image reconstruction. In this regard, claim 1 explicitly calls for a wired connection between the oscillator and the modulator. This is in stark contrast to that taught by Leussler.

As set forth above, Leussler teaches a wireless connection between the oscillator and its modulator. Specifically, the reference teaches that the "mixing signal" is supplied "to an antenna 226 which cooperates with the antenna 121 in the transmitter." *Id.* Thus, the reference is clear that there is not a wired connection between the oscillator and modulator, as claimed. Thus, claim 1 calls for subject matter neither taught nor suggested by Leussler.

Additionally, Appellant believes that claims 2, 4, and 6 are in condition for allowance at least pursuant to the chain of dependency. However, since claim 6 includes subject matter that is additionally distinguishable from the art of record, Appellant will specifically address those features that are additionally patentably distinct.

Claim 6

Claim 6 directly depends from claim 1 and further defines the transmitter of claim 1 as being "configured to transmit the modulated signal out of a bore defined by a magnet assembly of the MRI apparatus." Leussler fails to teach or suggest such a limitation. The reference teaches that "components 111 ... 126 are arranged in the direct vicinity of the coil system 10, for example, on said support on which the coil 10 is mounted." *Leussler*, col. 4, ll. 43-46. Coil 10 is identified as a high frequency receive coil. Therefore, the only guidance provided by Leussler is that the transmitter assembly be positioned near the receive coil, such as the coil support. There is no teaching nor has the Examiner identified any teaching within the reference that the modulated signal disclosed by Leussler is transmitted out the magnet bore. At best, the reference teaches that the antenna for transmission in positioned on a coil support and, thus, would not be within the bore of the magnet. As such, it is believed that which is called for in claim 6 is not taught, shown, or disclosed in the art of record. Accordingly, Appellant believes claim 6 is patentably distinct thereover.

CLAIM 7

Claim 7 calls for "a kit configured to retrofit an existing MRI apparatus ..., the kit consisting of: a modulator configured to modulate a carrier signal with an MR signal in an RF coil of the MRI apparatus; a transmitter configured to transmit the modulated signal; and a receiver wirelessly connected to the transmitter and configured to receive the modulated signal for subsequent data processing and image reconstruction." Not only does the reference fail to teach or suggest such electronic components packaged as a kit for retrofitting an existing MRI system, but Leussler teaches an assembly consisting of much more than a transmitter, a modulator, and a receiver.

In other words, Leussler is clear that all transmission to and from the receive coil 10 and accompanying circuit block 100 is achieved wirelessly via input antennas 221 and 226 and output antennas 115 and 210. Leussler is clear that all components of the circuit block 100 may be "mounted on a suitable substrate... so that this unit can be used for other coils." *Leusslser*, col. 4, ll. 46-50. Therefore, any kit, as taught by Leussler, necessarily would have to include the

components of circuit block 100 which are particularly designed for wireless transmission to and from the circuit block 100. Leussler does not teach any other arrangement.

Therefore, as claim 7 calls for a kit that is patentably distinct from any kit specifically taught by Leussler. Accordingly, claim 7 is believed to be in condition for allowance. Additionally, Appellant believes that claims 25-27 are in condition for allowance at least pursuant to the chain of dependency. However, since claims 26-27 include subject matter that is additionally distinguishable from the art of record, Appellant will specifically address those features that are additionally patentably distinct.

Claim 26

Claim 26 depends from claim 7 and further defines the receiver as including an electric dipole antenna. It is well-recognized that "electric dipole" is a specific type of antenna. As such, claim 26 restricts the claimed receiver as having a very specific type of antenna. While Leussler discloses antennas, the reference never teaches or suggests an electric dipole antenna. The reference generically refers to "antenna" and, as such, cannot be held to anticipate the specific antenna type called for in claim 26. As such, claim 26 is believed to be patentably distinct from that taught by Leussler.

Claim 27

Claim 27 depends from claim 7 and further defines the transmitter as being "configured to transmit the modulated signal out a bore defined by a magnet assembly of the MRI apparatus." Leussler fails to teach or suggest such a limitation. The reference teaches that "components 111 ... 126 are arranged in the direct vicinity of the coil system 10, for example, on said support on which the coil 10 is mounted." *Leussler*, col. 4, ll. 43-46. Coil 10 is identified as a high frequency receive coil. Therefore, the only guidance provided by Leussler is the transmitter assembly should be positioned near the receive coil, such as the coil support. There is no teaching nor has the Examiner identified any teaching within the reference that the modulated signal disclosed by Leussler is transmitted out the magnet bore, as called for in claim 27. At best, the reference teaches that the antenna for transmission in positioned on a coil support and, thus, would not be within the bore of the magnet. As such, that which is called for in claim 27 is

not taught, shown, or disclosed in the art of record. Accordingly, Appellant believes claim 27 is patentably distinct thereover.

CLAIM 17

Claim 17 was also rejected as being anticipated by Leussler. Claim 17 calls for an MRI system having, in part, "means for wirelessly transmitting the signal with a UHF carrier frequency signal to a receiver means." It is generally recognized that the UHF band includes those frequencies between 300 MHz and 3 GHz. *See* IEEE 100, The Authoritative Dictionary of IEEE Standards Terms, Seventh Ed. (provided as attachment to the After-Final Amendment/Response to Office Action Mailed February 23, 2005) By the Examiner's own admission, Leussler fails to teach UHF transmissions. Specifically, in the Office Action mailed February 23, 2005, the Examiner stated that Leussler "fails to teach operating at the wireless device at UHF frequency, and more specifically at 900 MHz." *Office Action*, February 23, 2005, p. 5. Thus, the Examiner has acknowledged that Leussler fails to teach transmitting MR signals with a UHF carrier frequency, as called for in claim 17. Accordingly, Appellant believes that claim 17 is directed to subject matter patentably distinct from that taught by Leussler. As such, Appellant requests allowance of claim 17.

Additionally, Appellant believes that claims 18 and 20-23 are in condition for allowance at least pursuant to the chain of dependency. However, since claims 20-23 include subject matter that is additionally distinguishable from the art of record, Appellant will specifically address those features that are additionally patentably distinct.

Claim 20

Claim 20 depends from claim 17 and further defines the MRI system of claim 17 as having "means for rectifying induced voltage generated during excitation of nuclei in the subject." In the office action mailed February 23, 2005 the Examiner also rejected claim 20 under 35 U.S.C. §103(a) and stated that Leussler "fails to teach rectifier." *Id.* Thus, not only does the reference fail to teach a rectifier or means for rectifying, but the Examiner recognized and admitted such a lacking in the reference. Therefore, it is believed that claim 20 is not anticipated by Leussler.

Claim 21

Claim 21 depends from claim 17 and further defines the MRI system as having at least a battery and "means for acquiring power from at least a B field associated with an RF pulse sequence to recharge at least one battery." Leussler fails to teach or suggest such a means. While Leussler teaches that a rechargeable battery may be used to supply power for components 111-126, the reference fails to teach or suggest charging of the battery using power derived from a B field. In fact, Leussler discloses that power for components 111-126 "can be derived directly from the high-frequency pulses." *Leussler*, col. 6, ll. 52-54. Thus, Leussler teaches two embodiments, a battery driven system and a system that can be powered from power derived from the HF pulses; however, the reference never teaches or suggests that both embodiments co-exist in the same system. As such, the rejection of claim 21 under 35 U.S.C. §102(b) cannot be sustained.

CLAIM 28

The Examiner also rejected claim 28 as being anticipated by Leussler. Claim 28 is directed to an MRI apparatus that includes, in part, "a transmitter configured to wirelessly transmit the carrier signal out of the bore of the magnet" and "a receiver having an electric dipole antenna wirelessly connected to the transmitter to receive the carrier signal transmitted by the transmitter." As previously established with respect to the remarks presented above regarding claims 6, 26, and 27, Leussler fails to teach or suggest the transmission of a carrier signal out the bore of the magnet of an MRI system or a receiver having an electric dipole antenna. To support a rejection under 35 U.S.C. §102(b) the single reference must teach each and every limitation. ("A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).) As Leussler fails to teach the claimed transmitter and receiver, claim 28 includes subject matter that is not shown or disclosed in the art of record. Accordingly, claim 28 is believed to be in condition for allowance.

B. REJECTION OF CLAIMS 3, 8, 10-16, AND 24 UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER LEUSSLER IN VIEW OF SCHOTZ ET AL.

Claim 3

Claim 3 depends from claim 1 and defines the carrier signal as having a frequency between approximately 300 MHz to approximately 3 GHz. The frequency is generally recognized as the UHF range. In rejecting claim 3, the Examiner relied upon the combination of Leussler with Schotz et al. The Examiner contends that the combination of references teaches that which is claimed. Appellant respectfully disagrees.

Appellant believes that a *prima facie* case of obviousness has not been established and one cannot be made based on the art of record. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. MPEP §2143. Second, there must be a reasonable expectation of success, and both the reasonable expectation of success and the teaching or suggestion to make the claimed combination must be found in the prior art, not in applicant's disclosure. *Id.*, citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2143.

Appellant believes that a *prima facie* case of obviousness cannot be made based on the art of record. Leussler is specifically directed to the wireless transmission of spin resonance signals from an MR examination apparatus. On the other hand, Schotz et al. is particularly concerned with the short range transmission of audio data from an audio system to an audio source. *Schotz et al.*, USP USP 5,581,617, col. 2, ll. 40–50. As such, the references are directed to very different purposes and there is no motivation to combine these references in the way done so by the Examiner. In fact, Leussler specifically teaches away from any transmission frequency substantially greater than "a few MHz to a few 100 MHz." *Leussler*, col. 3, ll. 67–68. Leussler teaches that "the spin resonance signal is mixed with a mixing signal of constant frequency f_1." *Leussler*, col. 3, ll. 55–57. Leussler continues by teaching that the transmission output signal "contains components having the difference frequency f_1-f_0 or the sum frequency f_1+f_0." *Leussler*, col. 3, ll. 60–62. Finally, Leussler teaches that "[t]he frequency f_1 of the mixing signal

is chosen (from a few MHz to a few 100 MHz)." *Leussler*, col. 3, ll. 67–68. Therefore, one of ordinary skill in the art will readily recognize that since the mixing frequency f_1 is chosen from between a few MHz to at most a few 100 MHz, the highest output frequency of any output signal would be only slightly more than a few hundred MHz. That is, since the output signal "contains components having the difference frequency f_1-f_0 or the sum frequency f_1+f_0" and f_1 is chosen from between a few MHz to a few 100 MHz the sum frequency could never be more than a few 100 MHz. *See Leussler*, col. 3, ll. 55–68. As such, Leussler teaches away from modulation and transmission of carrier frequencies in the UHF range. Therefore, under MPEP §2142, a combination of Leussler and Schotz et al. is impermissible.

Therefore, as claim 3, in part, further defines the carrier signal as having a frequency in the UHF range, it is believed, notwithstanding its dependency from what is believed an otherwise allowable claim, to call for subject matter patentably distinct from the art of record.

CLAIM 8

Claim 8 calls for, in part, an MRI apparatus having an "RF coil assembly including an RF modulator configured to modulate a UHF carrier frequency with the MR signal." As set forth above in the discussion regarding claim 3, the Examiner has not established a *prima facie* case for obviousness with respect to the combination of Leussler and Schotz et al. and the alleged teaching of a UHF carrier frequency. Accordingly, it is believed that claim 8 is patentably distinct from that suggested by the combination of Leussler and Schotz et al.

Additionally, Appellant believes that claims 10-16 are in condition for allowance at least pursuant to the chain of dependency.

Claim 24

Claim 24 depends from claim 7 and further defines the carrier signal as having a frequency between approximately 300 MHz and 3 GHz. As set forth with respect to claims 3 and 8, the combination of reference fails to teach or suggest transmission of MR signals with a UHF carrier. In fact, as set forth above, the Examiner has failed to established that there is a motivation within the references themselves to combine the reference in the manner suggested by the Examiner. That is, Leussler teaches a frequency range of no more than a "few

MHz". One skilled in the art would readily appreciate that 900 MHz is well outside a "few MHz". Moreover, Schotz et al. teaches that for wireless transmission of audio signal, "a carrier signal of a predetermined frequency of at least 900 MHz" is necessary. *Schotz et al.*, USP 5,581,617, col. 2, ll. 44-45. Therefore, given that Schotz et al. teaches at least 900 MHz and Leussler explicitly limits its communication to "a few MHz", one skilled in the art would not be motivated to combine the references as 900 MHz is clearly outside the contemplated and suggested range of "a few MHz". As such, claim 24 is believed to be patentably distinct from the art of record.

C. REJECTION OF CLAIM 20 UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER LEUSSLER IN VIEW OF GOTO

Claim 20

Claim 20 depends from claim 17 and further defines the MRI system as having "means for rectifying induced voltage generated during excitation of nuclei in the subject." While Appellant believes claim 20 to be allowable based on its dependency from an otherwise allowable claim, Appellant believes that the art of record fails to teach the claimed rectifying means. In the Office Action mailed February 23, 2005, the Examiner acknowledged that Leussler does not teach such a rectifying means and, as such, also applied Goto. *Office Action*, February 23, 2005, p. 5. However, notwithstanding a lack of motivation to combine the pair of references, the combination fails to teach or suggest the claimed rectifying means.

Goto teaches a method of shift measurement and phase shift correction, and an MRI apparatus for carrying out such methods. In the Description of the Prior Art, Goto states that known "MRI apparatus based on the permanent magnet also involve the above-mentioned problem of phase shift caused by the eddy current and, in addition, the problem of phase shift caused by the residual magnetization (attributable to a preceding encode gradient)." *Goto*, USP 6,218,834, col. 1, ll. 57-59 (parentheses added). Goto adds, "Specifically, the residual magnetization emerging in the magnetic rectifying plates, for example, increases and affects the phase shift significantly as the pulse amplitude increases." *Goto*, col. 1, ll. 59-63. The Examiner has asserted that the aforementioned "rectifying plates" constitute a "means for rectifying

induced voltage generated during excitation of nuclei in the subject," as called for in claim 20. Clearly that is not accurate.

There is no teaching or suggesting whatsoever that the rectifying plates disclosed by Goto rectifies a voltage that is induced during excitation of nuclei in a subject to be imaged. The reference merely discloses "magnetic rectifying plates" well-known to be present in permanent magnet MRI systems. Not only are such plates known, but they are known to not rectify an induced voltage generated when nuclei in a subject are excited. In fact, Goto refers to the rectifying plates as "magnetic rectifying plates" and, as such, discloses that the plates are used in "rectifying" magnetism not an induced voltage generated when the subject is excited. Accordingly, claim 20 is believed to call for subject matter neither taught nor suggested by the art of record.

8. CONCLUSION

In view of the above remarks, Appellant respectfully submits that the Examiner has provided no supportable position or evidence that claims 1-4, 6-8, 10-18, and 20-30 are not patentable. Accordingly, Appellant respectfully requests that the Board find claims 1-4, 6-8, 10-18, and 20-30 patentable over the prior art of record, direct withdrawal of all outstanding rejections and direct the present application be passed to issuance.

General Authorization for Extension of Time

In accordance with 37 C.F.R. §1.136, Appellant hereby provides a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefore. A Fee Transmittal authorizing charging of deposit account 07-0845 in the amount of $500.00 for the filing of this Appeal Brief is enclosed.

Respectfully submitted,

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Dated: August 23, 2005
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CLAIMS APPENDIX

1. (Previously Presented) A wireless RF module for an MRI apparatus, the wireless RF coil module comprising:

an oscillator configured to generate a carrier signal;

a modulator wired to the oscillator to modulate the carrier signal with an MR signal in an RF coil of the MRI apparatus;

a transmitter configured to transmit the modulated signal; and

a receiver wirelessly connected to the transmitter and configured to receive the modulated signal for subsequent data processing and image reconstruction.

2. (Original) The module of claim 1 wherein the modulator is further configured to amplitude modulate the carrier signal.

3. (Original) The module of claim 1 wherein the carrier signal has a frequency between approximately 300 MHz to approximately 3 GHz.

4. (Original) The module of claim 1 wherein the receiver is located remotely from the MRI apparatus.

5. (Cancelled)

6. (Original) The module of claim 1 wherein the transmitter is further configured to transmit the modulated signal out of a bore defined by a magnet assembly of the MRI apparatus.

7. (Previously Presented) A kit configured to retrofit an existing MRI apparatus to wirelessly transmit an MR signal from a receive coil of the MRI apparatus to a receiver configured to input the received MR signal to a data processor for processing and image reconstruction, the kit consisting of:

a modulator configured to modulate a carrier signal with an MR signal in an RF coil of the MRI apparatus;

a transmitter configured to transmit the modulated signal; and

a receiver wirelessly connected to the transmitter and configured to receive the modulated signal for subsequent data processing and image reconstruction.

8. (Previously Presented) An MRI apparatus comprising:

an MRI system having a number of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field;

an RF transceiver system; and

an RF coil assembly configured to wirelessly transmit an MR signal to the RF transceiver system, the RF coil assembly including an RF modulator configured to modulate a UHF carrier frequency with the MR signal.

9. (Cancelled)

10. (Previously Presented) The MRI apparatus of claim 8 wherein the RF modulator is further configured to amplitude modulate the UHF carrier frequency with the MR signal.

11. (Original) The MRI apparatus of claim 8 wherein the RF coil assembly further comprises a transmitter configured to wirelessly transmit the MR signal out of the bore of the magnet.

12. (Original) The MRI apparatus of claim 11 wherein the RF coil assembly further comprises a receiver wirelessly connected to the transmitter and configured to receive the modulated signal transmitted by the transmitter.

13. (Original) The MRI apparatus of claim 12 further comprising an electric dipole antenna attached to the receiver.

14. (Original) The MRI apparatus of claim 12 wherein the receiver is positioned at an end of the bore from the MRI system.

15. (Original) The MRI apparatus of claim 11 further comprising a rechargeable battery configured to provide power to the RF modulator and the transmitter.

16. (Original) The MRI apparatus of claim 8 wherein the RF coil assembly further comprises a pre-amplifier, a local oscillator, and a 900 MHz transmitter.

17. (Previously Presented) An MRI system comprising:

means for positioning a subject to be scanned within a bore of a magnet assembly for MR data acquisition;

means for impressing a polarizing magnetic about the bore of the magnet;

means for exciting nuclei in the subject;

means for sensing signals resulting from the exciting nuclei in the subject;

means for wirelessly transmitting the signals with a UHF carrier frequency signal to a receiver means; and

means for reconstructing at least one image of the subject from the signals received by the receiver means.

18. (Original) The MRI system of claim 17 wherein the receiver means includes means for wirelessly receiving the signals transmitted by the means for wirelessly transmitting.

19. (Cancelled)

20. (Previously Presented) The MRI system of claim 17 further comprising means for rectifying induced voltage generated during excitation of nuclei in the subject.

21. (Previously Presented) The MRI system of claim 17 further comprising at least one battery and means for acquiring power from at least a B field associated with an RF pulse sequence to recharge at least one battery.

22. (Original) The MRI system of claim 17 further comprising means for improving SNR.

23. (Previously Presented) The kit of claim 7 wherein the modulator is further configured to amplitude modulate the carrier signal.

24. (Previously Presented) The kit of claim 7 wherein the carrier signal has a frequency between approximately 300 MH_Z to approximately 3 GH_Z.

25. (Previously Presented) The kit of claim 7 wherein the receiver is located remotely from the MRI apparatus.

26. (Previously Presented) The kit of claim 7 wherein the receiver includes an electric dipole antenna.

27. (Previously Presented) The kit of claim 7 wherein the transmitter is further configured to transmit the modulated signal out of a bore defined by a magnet assembly of the MRI apparatus.

28. (Previously Presented) An MRI apparatus comprising:

an MRI system having a number of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field;

an RF transceiver system wired to a modulator;

an RF coil assembly configured to wirelessly transmit an MR signal to the RF transceiver system, the RF coil assembly comprising:

the modulator configured to modulate a carrier signal;

a transmitter configured to wirelessly transmit the carrier signal out of the bore of the magnet; and

a receiver having an electric dipole antenna wirelessly connected to the transmitter to receive the carrier signal transmitted by the transmitter.

29. (Previously Presented) The method of claim 1 wherein the receiver includes an electric dipole antenna.

30. (Previously Presented) The MRI system of claim 17 further comprising means for acquiring power for components of the MRI system from a B field associated with an RF transmit pulse sequence from the means for exciting nuclei in the subject.

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Effective on 12/8/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant Claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 500.00

Complete if Known	
Application Number	10/063,550
Filing Date	May 2, 2002
First Named Inventor	Eddy B. Boskamp
Examiner Name	Jung, W.
Art Unit	3737
Attorney Docket No.	GEMS8081.091

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 07-0845 Deposit Account Name: General Electric Co.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charges fee(s) indicated below, except for the filing fee

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50	25
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims	Extra Claims	Fee ($)	Fee Paid ($)
_____ - 20 or HP =	_____	x _____	= _____

HP = highest number of total claims paid for, if greater than 20

Indep. Claims	Extra Claims	Fee ($)	Fee Paid ($)
_____ - 3 or HP =	_____	x _____	= _____

HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41 (a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
_____ - 100 =	_____	/ 50 = _____ (round up to a whole number)	x _____	=

4. OTHER FEE(S)

	Fees Paid ($)
Appeal Brief	$500.00

SUBMITTED BY

Signature		Registration No. (Attorney/Agent) 38,368	Telephone (262) 376-5170
Name (Print/Type)	Timothy J. Zolkowski		Date 8/23/05